

## Phenology of Ammophiline Wasps in a Premontane Wet Forest in Costa Rica (Hymenoptera, Sphecidae, Ammophilini)

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**Abstract.**—Population fluctuations sampled by Malaise traps are reported for three species of *Ammophila* and three species of *Eremnophila* during a 16 month period at Finca Montezuma in Guanacaste Province, Costa Rica. Populations of *Ammophila centralis* Cameron and *Eremnophila melanaria* (Dahlbom) reach their peak during the wet season, and populations of *Ammophila picipes* Cameron and *Eremnophila aureonotata* (Cameron) are greatest during the dry season. *Ammophila gaumeri* Cameron and *Eremnophila opulenta* (Lepeletier) were infrequently taken at the site, and no conclusions regarding them are possible. *Podalonia montana* (Cameron) is recorded from Costa Rica for the first time.

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Three genera of Ammophilini occur in Costa Rica, *Ammophila* Kirby, *Eremnophila* Menke, and *Podalonia* Fernald. In this paper we report on population fluctuations of species in the first two genera at one location in northwestern Costa Rica over a period of 16 months in 1992 and 1993. Janzen (1983) described a variety of factors that possibly have roles in regulating insect populations throughout the year in Costa Rica, particularly in the lowlands of Guanacaste Province, but he stressed that "... we know next to nothing about the ecology of almost all Costa Rican insects." This is certainly true of the ammophiline wasps. While our data suggest that population fluctuations throughout the year appear to be influenced by rainfall/temperature in some species, we know nothing about the influence of other environmental factors such as sunlight, wind, parasites, etc. We do not know how long adults live, or how many generations each species has per year. We do not know if their population fluctuations are tied to prey availability and abundance. For that matter, we know nothing

about the prey of Costa Rican ammophilines other than that they take caterpillars.

The study site was premontane wet forest in the transition between wet and dry zones located at Finca Montezuma, Guanacaste Province. This finca is located 3 km southeast of Rio Naranjo (lat. 10° 42", long. 85° 5") at an altitude of 450 m. Total precipitation at Finca Montezuma averages about 2200 mm per year, with the majority of rainfall occurring from June through December (Fig. 1). Defoliation is not total during the drier part of the year because of mist blown by trade winds over the continental divide from the wet zone. Flowering plants are common throughout the year. Temperature at Finca Montezuma fluctuates about 3° C during the year and reaches its maximum during the dry season (Fig. 2).

One of us, Parker, operated 12 Malaise traps continuously for several years at Finca Montezuma. The traps used were of various designs and set up at the ecotone between forests and crop lands. Most traps were between the edge of the

## Rainfall, Finca Montezuma, 1992-1993

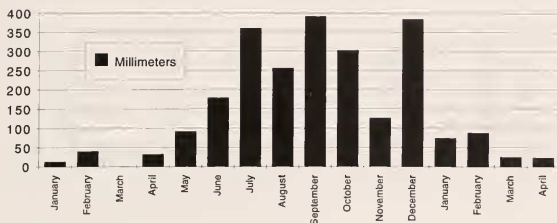


Fig. 1. Bar graph showing rainfall in millimeters at Finca Montezuma from January 1992 to April 1993.

forest and coffee plantations, but some traps were placed along roads that ran through the forest. The collecting heads of the traps were sprayed with locally purchased insecticide; the insects trapped in the bottles died rapidly. The trap bottles were emptied daily and the insects sorted and stored. The *Ammophilini* taken in the traps during 1992 and the first four months of 1993 were placed in bags of 70% alcohol and sent to Menke for identification. Menke then tallied the numbers of each sex for each species on

a monthly basis and plotted them on graphs (Figs. 3-8).

Four species of *Ammophila* (*picipes* Cameron, *centralis* Cameron, *gaumeri* Cameron and *procera* Dahlbom) and three species of *Eremnophila* (*aureonotata* (Cameron), *melanaria* (Dahlbom), and *opulenta* (Lepeletier)) are known in Costa Rica. *Ammophila procera* was the only wasp not taken in the traps during the survey, although it occurs at lower elevations in Guanacaste Province. The absence of *procera* in the traps may indicate that it occupies different

## Temperature, Finca Montezuma, 1992-1993

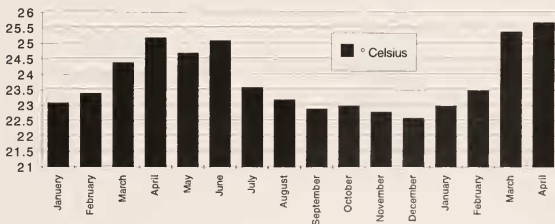


Fig. 2. Bar graph showing temperature fluctuations in Celsius at Finca Montezuma from January 1992 to April 1993.

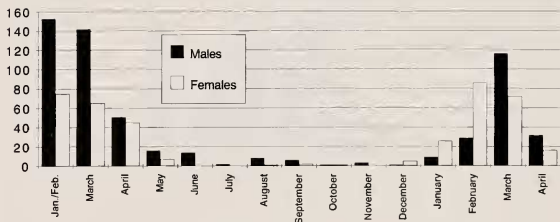
***Ammophila picipes*, 1992-1993**

Fig. 3. Bar graph showing number of males and females of *Ammophila picipes* taken at Finca Montezuma from January 1992 to April 1993.

habitats. One example of the genus *Podalonia* was taken during the survey, a male of *montana* (Cameron) captured in February, 1992. This specimen proves that all three genera occur at the survey site, but more importantly, it represents the first record of this species in Costa Rica. *Podalonia montana* was known previously from Mexico, Guatemala and Nicaragua. Three females of *montana* have since been found among material collected by Parker at Finca Montezuma, using an insect net, in February and March 1992.

The most common species at the site was *A. picipes*, which is ubiquitous throughout Mexico and Central America and extends into Arizona, New Mexico and Texas. The second most abundant taxon is *E. aureonotata*, a species that is common over most of the eastern half of North America and which ranges south as far as Guanacaste Province, Costa Rica. The remaining species taken in the traps were far less abundant, particularly *E. melanaria* and *E. opulenta*. However, *E. melanaria* is a common species over most of

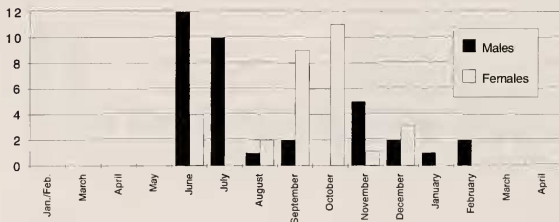
***Ammophila centralis*, 1992-1993**

Fig. 4. Bar graph showing number of males and females of *Ammophila centralis* taken at Finca Montezuma from January 1992 to April 1993.

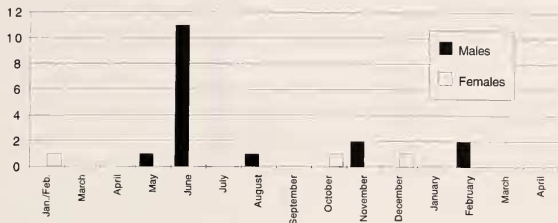
***Ammophila gaumeri*, 1992-1993**

Fig. 5. Bar graph showing number of males and females of *Ammophila gaumeri* taken at Finca Montezuma from January 1992 to April 1993.

its range, which extends from tropical Mexico to Argentina. *Eremnophila opulenta* has a similar distribution but is less frequently collected. *Ammophila centralis* ranges from the southern tip of Texas to the xeric regions of northwestern Venezuela, and *A. gaumeri* has a similar distribution although it does not occur north of tropical Mexico.

When the plotted population fluctuations for these species during the period covered (Figs. 3-8) are compared with

rainfall for the same period (Fig. 1), some obvious differences can be seen. Two species in each genus have highest population levels at different times of the year. The wet season group (*A. centralis* and *E. melanaria*) seems absent during the major part of the dry season. On the other hand, the dry season group (*A. picipes* and *E. aureonotata*), occurs throughout the year. The other species, *A. gaumeri* and *E. opulenta* occur at such a low density at Finca Montezuma that no conclusions can be made

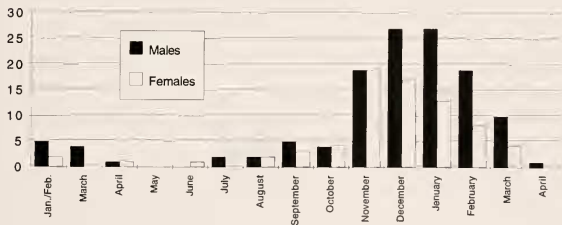
***Eremnophila aureonotata*, 1992-1993**

Fig. 6. Bar graph showing number of males and females of *Eremnophila aureonotata* taken at Finca Montezuma from January 1992 to April 1993.

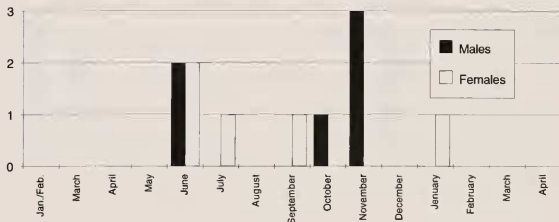
**Eremnophila melanaria, 1992-1993**

Fig. 7. Bar graph showing number of males and females of *Eremnophila melanaria* taken at Finca Montezuma from January 1992 to April 1993.

except to say that *gaumeri* is present sporadically through the year, with an apparent peak in June, the beginning of the wet season (Fig. 5). The two females of *opulenta* were taken in the rainy season (Fig. 8).

Temperature (Fig. 2) may also be a factor in population fluctuations of these wasps. Certainly its fluctuations at Finca Montezuma complement our data on wasp distribution based on rainfall.

To obtain wholly satisfying results would require operating traps for several years, carefully monitoring species taken

in each trap, rather than pooling the samples as was done here. We have no data on the efficacy of trapping populations of *Ammophila*, *Eremnophila*, and *Podalonia* with Malaise traps. Our data could be artificial, but there seems to be seasonal separation of species based on rainfall and temperature.

#### ACKNOWLEDGEMENTS

Vincent Tepedino and Terry Griswold (Bee Biology and Systematics Laboratory, USDA, Utah State University, Logan, Utah), and Steve Nakahara and

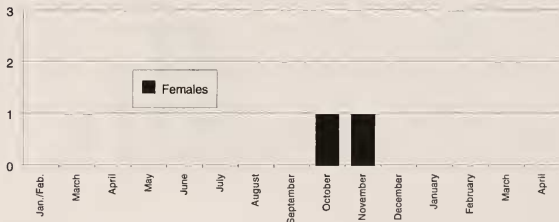
**Eremnophila opulenta, 1992-1993**

Fig. 8. Bar graph showing number of females of *Eremnophila opulenta* taken at Finca Montezuma from January 1992 to April 1993.

Ron Hodges (Systematic Entomology Laboratory, USDA, Beltsville, Maryland) reviewed the manuscript and offered helpful suggestions. The bar graphs were computer generated by Terry Nuhn (Systematic Entomology Laboratory, USDA, Washington D. C.).

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